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(54) **GENERATION OF DYNAMIC CONTENT INTERFACES**

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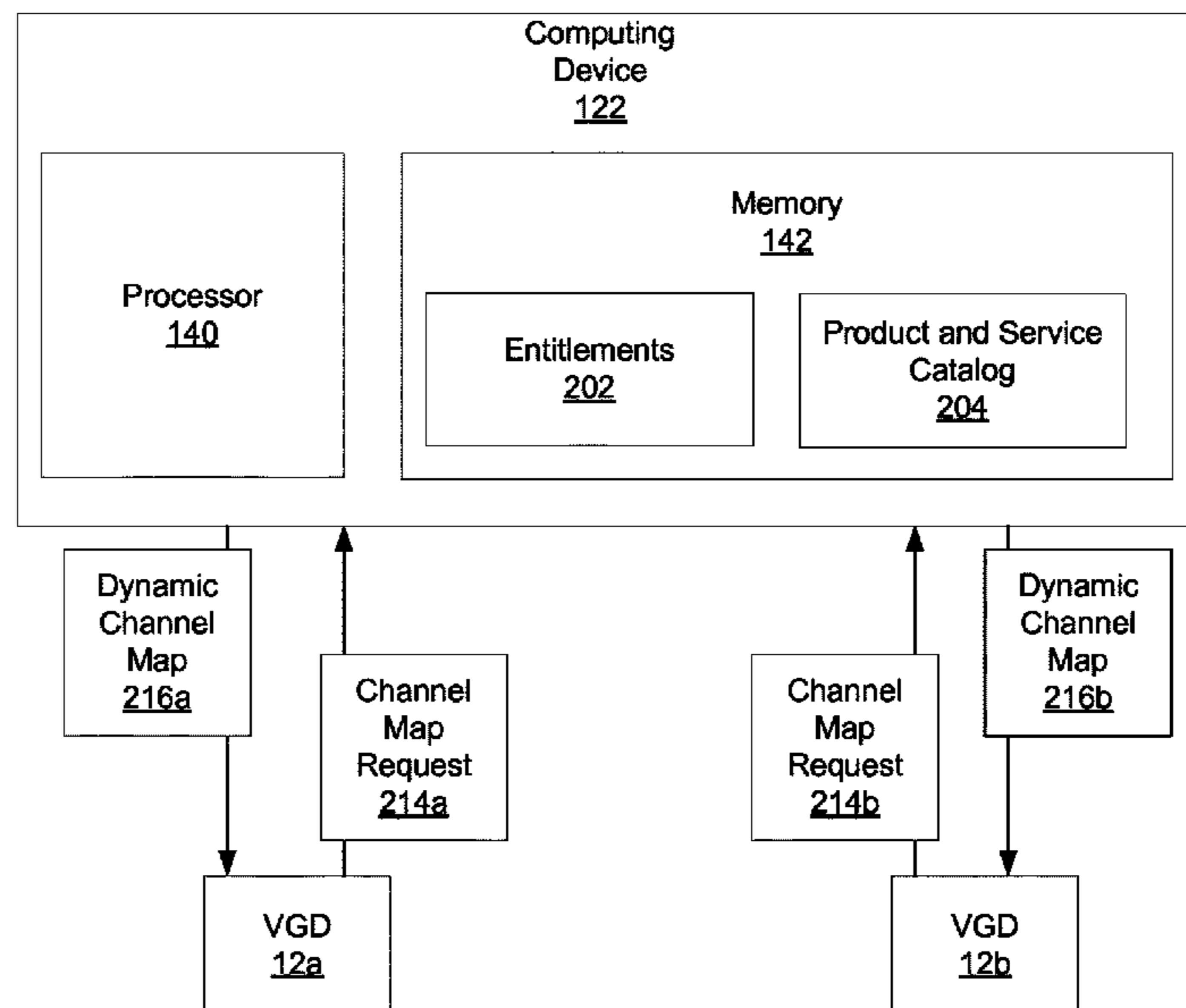
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(57) **ABSTRACT**
Example embodiments relate to generation of dynamic content interfaces based on device capabilities and user entitlements. Multiple devices associated with a user account may each request a content interface. Generation of the content interfaces may be based on capability information of the devices and a tier entitlement associated with the user account. A service included in both the content interfaces may be assigned a same virtual channel in each of the content interfaces.

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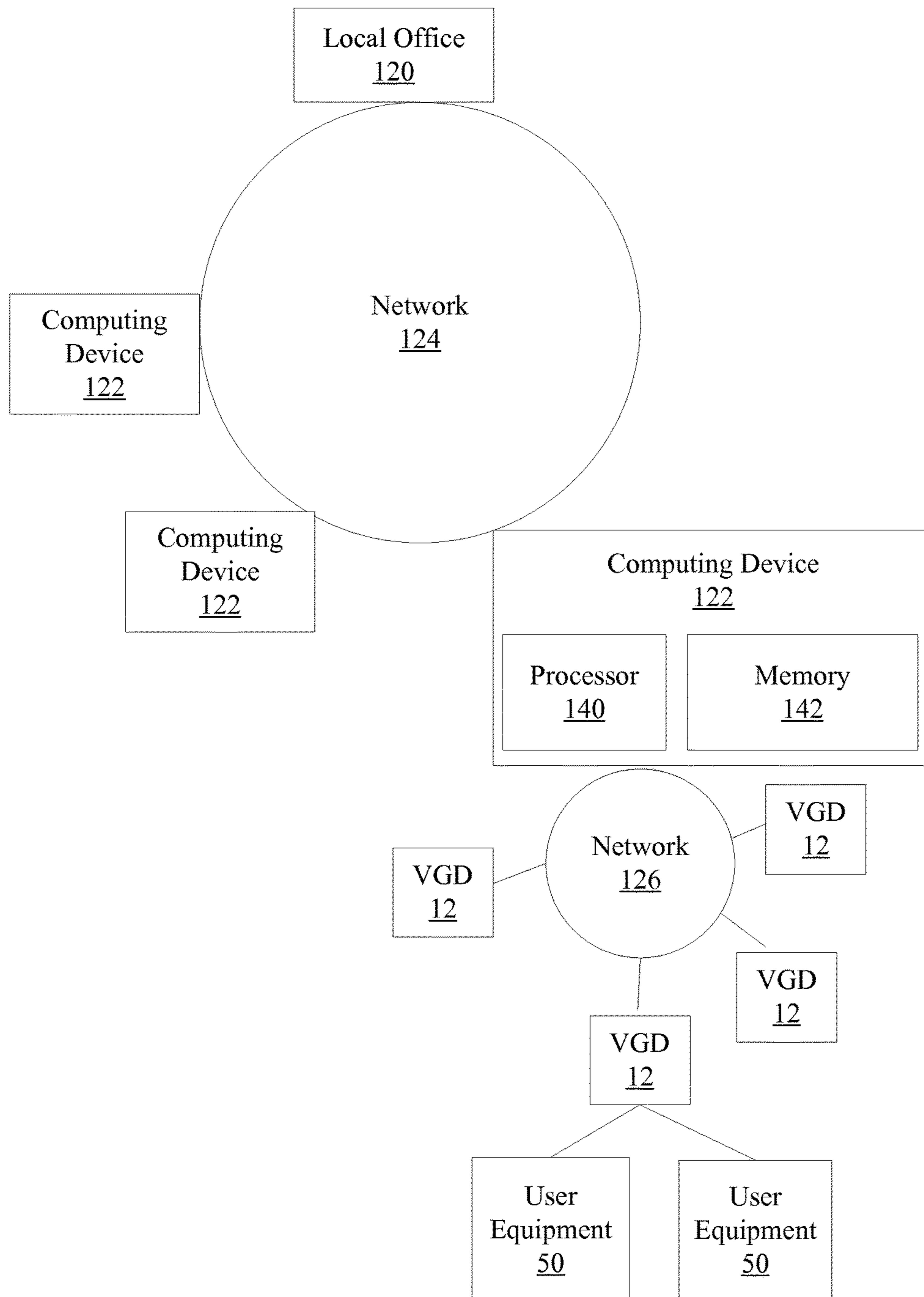


FIGURE 1

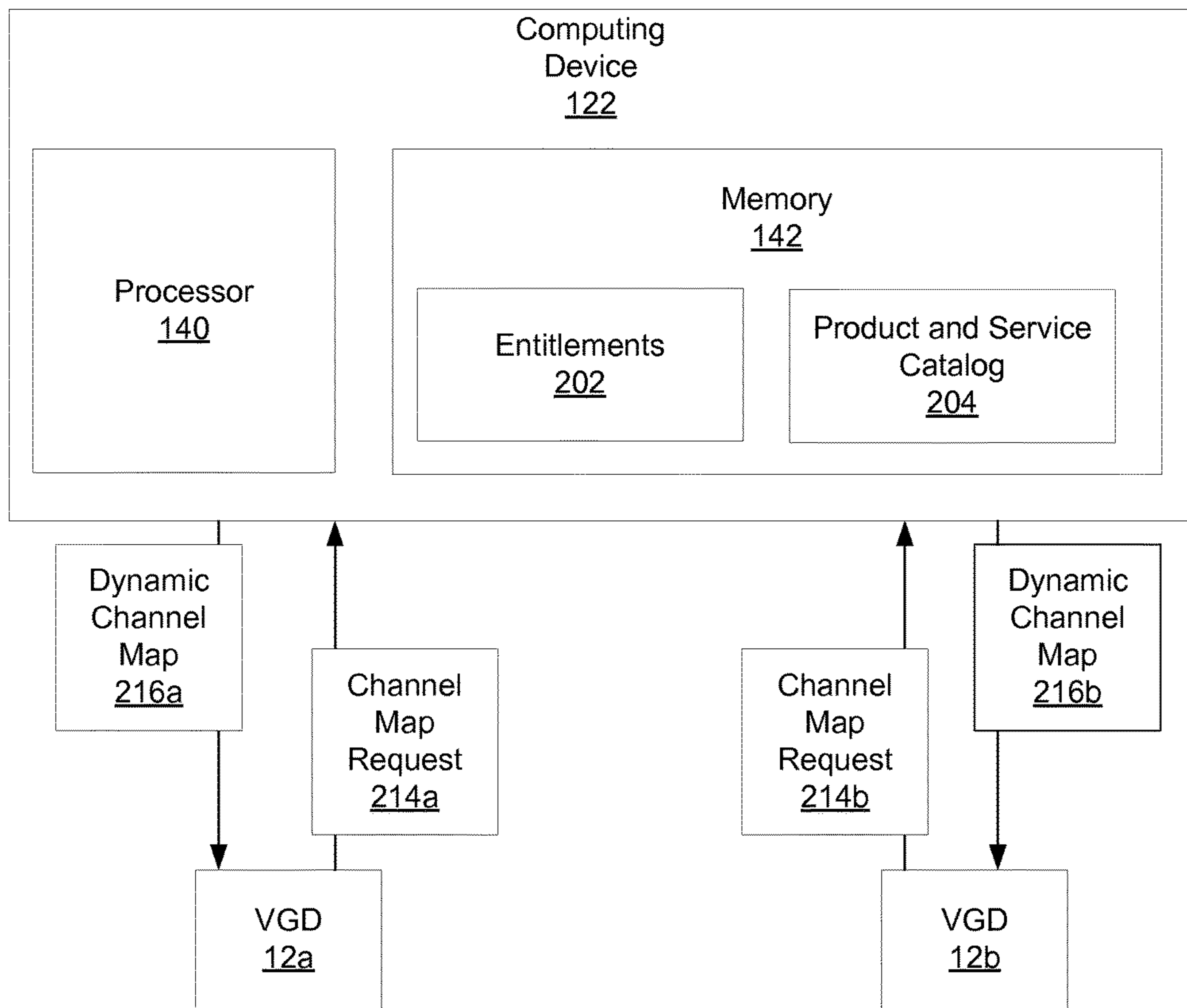


FIGURE 2

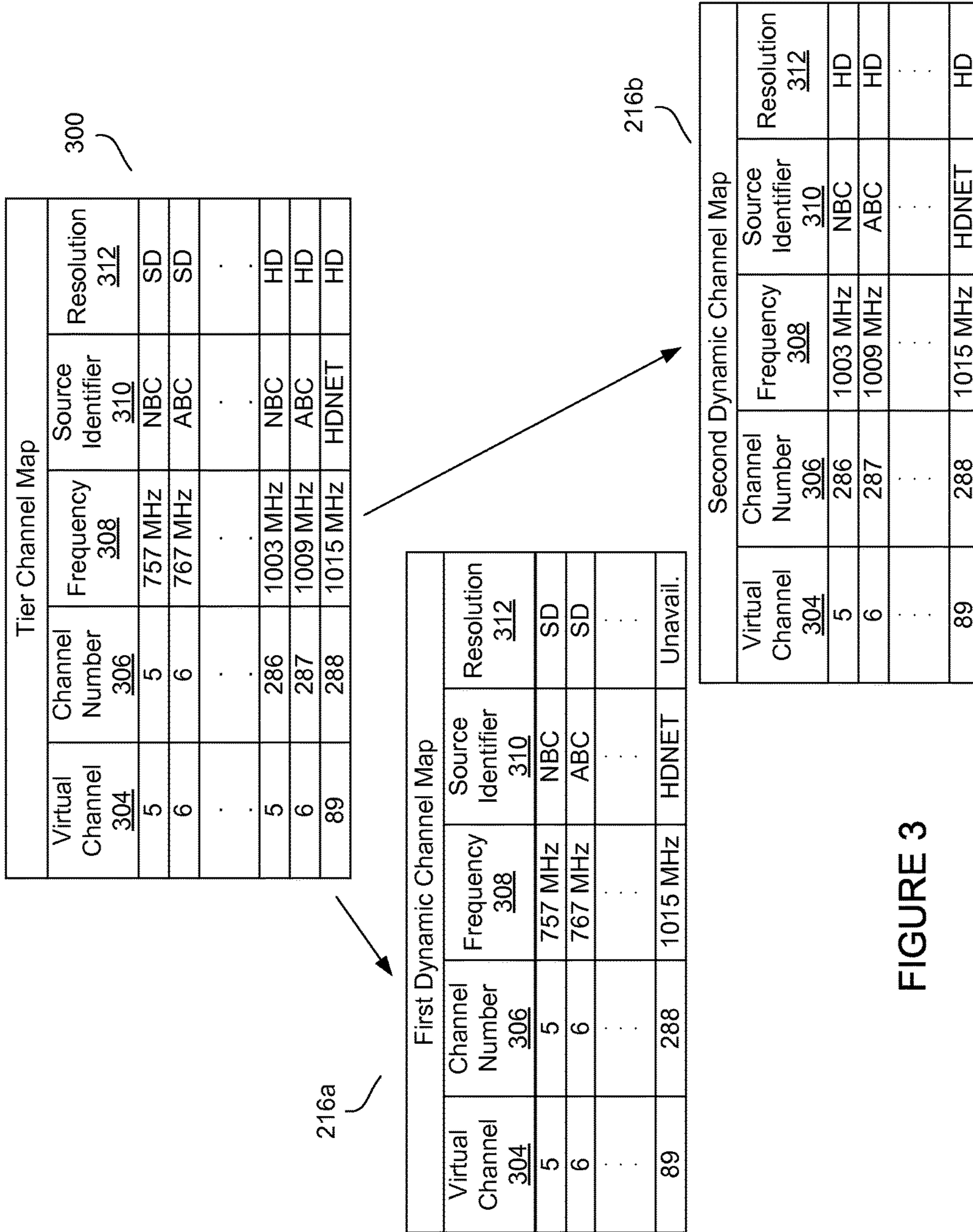


FIGURE 3

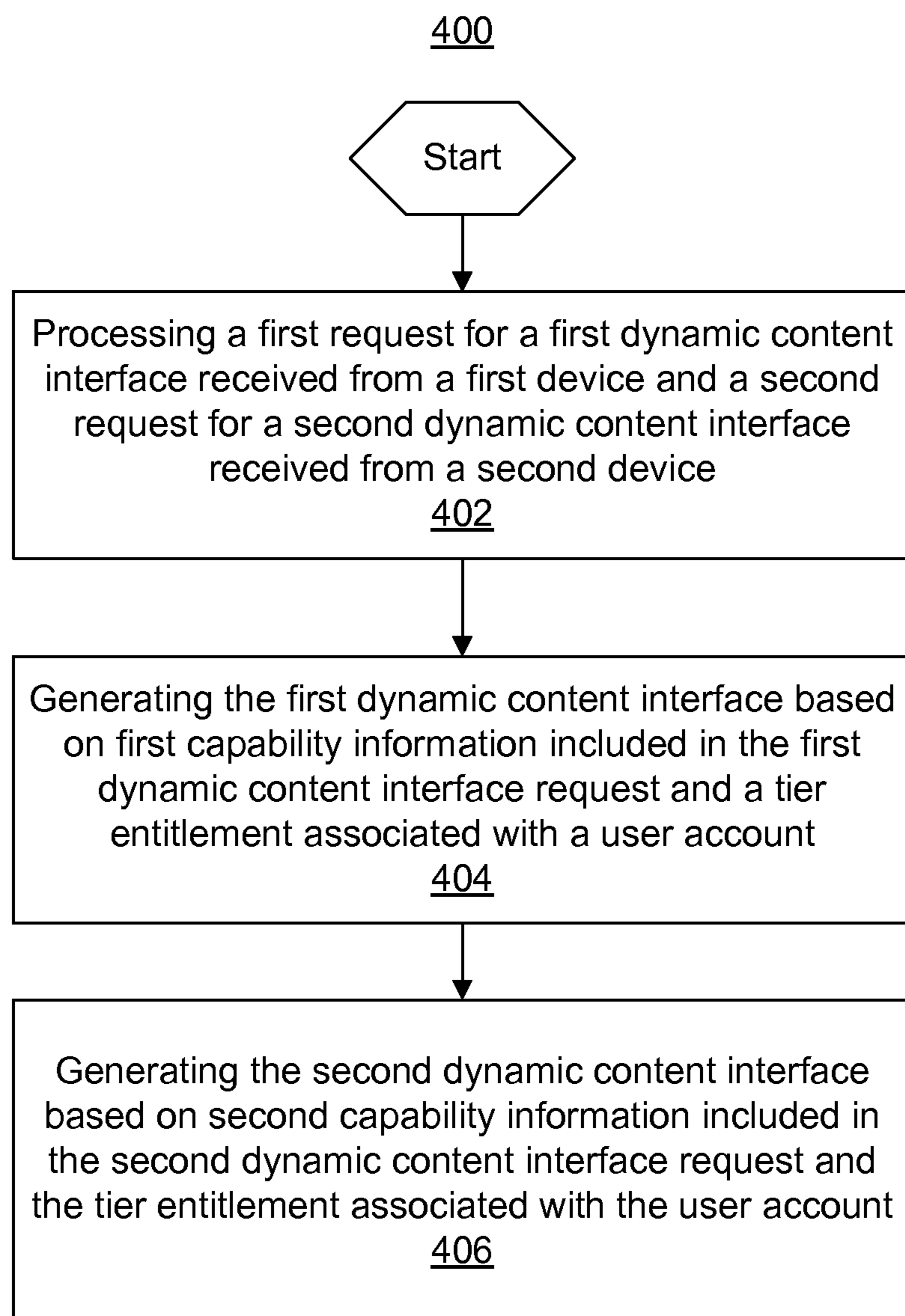


FIGURE 4

1**GENERATION OF DYNAMIC CONTENT
INTERFACES****CROSS REFERENCE TO RELATED
APPLICATIONS**

This application is a continuation of U.S. patent application Ser. No. 13/469,860, filed May 11, 2012, which is incorporated herein by reference.

BACKGROUND

Known implementations of content interfaces, such as channel maps, have shortcomings. For example, such interfaces may fail to account for variations in device system parameters such as entitlements. For example, a particular user may not be entitled to premium channel access in a network. However, because multiple channel maps may be maintained, inefficiencies further increase. The following disclosure identifies and provides solutions for implementations of content interfaces.

BRIEF SUMMARY

In light of the foregoing background, the following presents a simplified summary of the present disclosure in order to provide a basic understanding of some aspects of the invention. This summary is not an extensive overview of the invention. It is not intended to identify key or critical elements of the invention or to delineate the scope of the invention. The following summary merely presents some concepts of the invention in a simplified form as a prelude to the more detailed description provided below.

The disclosure relates to a system, device, computer readable media, and method to dynamically generate content interfaces based on device capabilities and user entitlements. Aspects of the disclosure may be provided in one or more computer-readable medium having computer-executable instructions that, when executed by at least one processor, cause a computer, user terminal, or other apparatus to at least perform one or more of the processes described herein. The computer-readable medium may be a memory and/or may be non-transitory.

In some aspects, a first request for a first dynamic content interface received from a first device and a second request for a second dynamic content interface received from a second device may be processed, wherein the first and second devices are associated with a user account. The first dynamic content interface may be generated based on first capability information included in the first dynamic content interface request and a tier entitlement associated with the user account. The second dynamic content interface may be generated based on second capability information included in the second dynamic content interface request and the tier entitlement associated with the user account, wherein a service identified in both the first and second dynamic content interfaces is assigned a same virtual channel in each of the content interfaces.

BRIEF DESCRIPTION OF THE DRAWINGS

Understanding of the disclosure may be facilitated by consideration of the following detailed description of the embodiments, taken in conjunction with the accompanying drawings, in which like numerals refer to like parts and in which:

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FIG. 1 is a block diagram that illustrates an example system, in accordance with various aspects of the disclosure.

FIG. 2 is a block diagram that illustrates example aspects of interaction between computing devices, in accordance with various aspects of the disclosure.

FIG. 3 illustrates examples of content interfaces, in accordance with various aspects of the disclosure.

FIG. 4 is a flow diagram illustrating a method, in accordance with various aspects of the disclosure.

DETAILED DESCRIPTION

It is to be understood that the figures and descriptions have been simplified to illustrate elements that are relevant for a clear understanding, while eliminating, for the purpose of brevity, many other elements found in typical communication devices, systems and methodologies. Those of ordinary skill in the art will thus recognize that other elements and/or steps are desirable and/or may be included. However, because such elements and steps are well known in the art, a discussion of such elements and steps is not provided herein. Furthermore, the embodiments identified and illustrated herein are for exemplary purposes only, and are not meant to be exclusive or limited in their description.

FIG. 1 is a block diagram that illustrates an example system for providing dynamic content interfaces, in accordance with various aspects of the disclosure. A content interface may provide a computing device with information to enable access to a service. In an example, a content interface may be a channel map or a content map. Content interface may also list services that may be accessed by a content device by manners instead of or in addition to channels. Services may include access to applications, documents, games, video programs, audio programs, other types of content, and combinations thereof. Services may be available for free or for a fee. Local Office 120 (e.g., headend) and one or more computing devices 122 may be directly or indirectly associated with a network 124 (e.g., provider or Multiple System Operator (MSO) network). In an example, a computing device 122 may be a server. Local Office 120 may include a master facility, under the control of a provider, such as the MSO, for receiving content, such as, for example, television video programs, for processing and distribution over network 124. Network 124 may allow for distribution of content and data, from Local Office 120 to one or more computing devices 122. The one or more computing devices 122 may be and/or include one or more servers, relays, and the like, such as one or more provider edge servers. An edge server may be a bi-directional communication server that may include storage, such as a cache, for storing frequently requested data. The computing devices 122 may distribute content to one or more local video generation devices (VGDs) 12 via a network 126.

VGD 12 may present content (e.g., video, audio) to a user received from the Local Office 120 or other content source, or may be coupled to another video display device, such as, for example, user equipment 50 for presenting the content. VGD 12 may be, for example, a display, a television set, a mobile phone, a set top box, computer, or other device capable of audiovisual presentation. User equipment 50 may be, for example, a display, a television set, computer monitor, a mobile device, and the like. In an example, VGD 12 may include an embedded cable modem (eCM) operable using the "Data-Over-Cable Service Interface Specifications, e-DOCSIS™ Specification, CM-SP-eDOCSIS-I18-090529," the contents of which are herein incorporated by reference in their entirety. An eCM may perform a network

entry, or “provisioning,” process in accordance with the e-DOCSIS specification to obtain a network configuration, the time and date, download a DOCSIS configuration file, and registering and completing DOCSIS network entry. Further, although the examples discussed in this disclosure include video content delivery, those skilled in the art will appreciate, in light of the disclosure, that the examples discussed herein may additionally be applicable to content delivery systems generally.

Each of devices **12**, **50**, **120**, and **122** may include at least one processor and may include one or more computer readable media storing computer executable instructions that, when executed, cause one or more of the devices **12**, **50**, **120**, and **122** to perform the operations described herein. For example, FIG. 1 illustrates a computing device **122** including a processor **140** and computer readable media **142**. Each depicted device in FIG. 1, as well as in the other figures, may also include a processor **140** and computer readable media embodied as memory **142**. In an example, computer readable media may be tangible and may be non-transitory. Computer readable media may be any available media that may be accessed by a computing device **122** (e.g., server) and include both volatile and nonvolatile media, removable and non-removable media. Computer storage media include, but is not limited to, a hard drive, a flash drive, random access memory (RAM), read only memory (ROM), electronically erasable programmable read only memory (EEPROM), flash memory or other memory technology, CD-ROM, digital versatile disks (DVD) or other optical disk storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or any other medium that can be used to store the desired information and that can be accessed by a computing device.

FIG. 2 is a block diagram that illustrates example aspects of interaction between a computing device **122** and video generation devices **12a-b**, and FIG. 3 illustrates examples of a tier channel map **300** and dynamic channel maps **216**, in accordance with various aspects of the disclosure. Initially, a user may sign up with a service provider to access certain services. For example, a user may sign up for services providing access to one or more of video programs, audio programs, data, applications, games, documents, telephone services, or other network-based services. In an example, a service provider may provide different tiers of services that a user can select to purchase. For instance, a tier may correspond to a set of television channels, where content on a particular channel is provided by a particular content creator (e.g., channel **5** for HBO®). In an example, a first tier may be a basic tier providing access a first predetermined set of television channels, a second tier may be an expanded tier providing access to a second predetermined set of television channels, and a third tier may provide a user with a la carte selection of which channels to include. Any number of tiers may be used, and one or more channels may be included in multiple tiers or may be unique to a particular tier. Tiers may also list one or more games, applications, documents, or other content items to which a subscribing user may access.

To obtain access to a particular tier, the user may electronically subscribe using their VGD **12** by communicating a request to the computing device **122** identifying a particular tier, or by contacting a customer service representative. Once a particular tier has been ordered, the computing device **122** may receive and store information on tier entitlement **202** in memory **142** (e.g., a database), for this user identifying the tier to which the user has subscribed. In an example, computing device **122** may establish an account in memory **142** for a user specifying to which tier of entitle-

ments a user has subscribed. Entitlements may include channel entitlements, program entitlements, authorizations, application entitlements, document entitlements, game entitlements, and the like, for example. Memory **142** may also store entitlements for other users served by the computing device **122**. Memory **142** may store a product and service catalog **204** listing available products and services that can be provided to a user, as well as sources for the products and services.

In an example, catalog **204** may list sources for each service. For example, a particular service may be available from one or more SD video sources, HD video sources, or wireless access protocol (WAP) sources or similar mobile video sources. Memory **142** may include, for example, a relational database relating a particular service with multiple sources for that service, such as by type, by market, by geography, or by other factors.

For each tier, computing device **122** may maintain a tier channel map **300**. With reference to FIG. 3, the tier channel map **300** may provide information on the services available in that tier. The tier channel map **300** may be a lineup of services available to users and may include analog and digital channel data. In an example shown in FIG. 3, tier channel map **300** may include a virtual channel column **304**, a channel number column **306**, a frequency column **308**, a source identifier column **310**, and a resolution column **312**. The virtual channel column **304** may list a virtual channel of a service, rather than an actual channel on which a VGD **12** receives the service. In an example, a user may access content using different VGDs **12**, where a first VGD may access a version of content in an HD format and a second VGD may access a version of the content in an SD format. Virtual channels may be used so that a user may receive content from a source on the same virtual channel, regardless of which channel a VGD **12** is actually being used to access the content. As seen in tier channel map **300**, the virtual channel for both SD and HD channels of NBC is the same (e.g., virtual channel **5**), even though the SD channel is transmitted at frequency 757 MHz and the HD channel is transmitted at frequency 1003 MHz. Similarly, first and second dynamic channel maps **216a-b** identify a same virtual channel for both SD and HD channels of NBC. In a further example, the virtual channel for both SD and HD channels of NBC may be the same (e.g., virtual channel **5**), even though the SD channel is transmitted at frequency 757 MHz and the HD channel is provided to the VGD via a data stream. Use of virtual channels may provide, for example, the user with a consistent experience regardless of whether they are viewing a service in their home using a set top box, or on the go using a mobile phone.

With reference to the tier channel map **300** in FIG. 3, the channel number column **306** may identify a particular frequency band on which a channel is transmitted. Examples of transmission may include broadcasting and unicasting. The frequency column **308** may identify a frequency corresponding to a particular channel number. Instead of or in addition to identifying a frequency, the tier channel map **300** may identify a network address of a device providing a data stream (e.g., MPEG stream) of the content. For example, VGD **12** may use the network address to access a data stream providing an application, a game, a document, or other content item. The source identifier column **310** may identify a creator of content transmitted on a particular channel or data stream. The resolution column **312** may identify the resolution of programming being transmitted on

a particular channel. For example, a resolution of a program may be one or more of SD multicast, HD multicast, and low bandwidth multicast.

Tier channel map **300** may be considered a superset of information from which dynamic channel maps **216** may be created. In an example, tier channel map **300** may include information on services that not all VGDs **12** a user may have are capable of rendering. For instance, tier channel map **300** may include information on high definition (HD) channels and standard definition channels (SD) of a particular tier.

Frequently, a user may have more than one VGD **12**. For example, a user may have a gateway (e.g., set top box), a tablet computer (e.g., an IPAD®), and a mobile phone. Each of these VGDs may have different capabilities for rendering content. In an example, the VGDs may differ in the resolution of video they are able to display. Some may be able to present high definition video, others may only be able to present standard definition video, and some may only be able to present low definition video. To accommodate for these differences and rather than sending the entire tier channel map **300**, computing device **122** may generate a dynamic channel map **216** that is tailored to the capabilities of VGDs **12**. Examples of dynamic channel maps **216a-b** are shown in FIG. 3 and requesting a dynamic channel map is discussed in FIG. 2.

With reference to FIG. 2, after VGD **12a** is initially provisioned, VGD **12a** may communicate a request **214a** for a dynamic channel map **216a** to the computing device **122**. Request **214a** may be responsive to a query or ping, such as during provisioning, or may be proactively generated, in whole or in part, by the video generation device **12a**. Request **214a** may be embodied in Internet Protocol (IP) data or non-IP data. Request **214a** may include a device identifier and/or a user identifier to uniquely identify the user and the type of VGD that sent the request. Request **214a** may also include capability information of the requesting VGD, such as, for example, the features supported by the VGD **12a**. In an example, request **214a** may indicate that the VGD **12a** is a mobile device, HD device, or non-HD device. Also, request **214a** may include information on a retailer of a device, a part number of the device, a serial number of the device, or the like, from which a device type may be assessed. This information may be included in request **214a**, or, for example, request **214a** may include a unique device identifier that may be matched to a device type for the VGD **12a** identified by that identifier in memory **142**. Upon receipt of request **214a**, computing device **122** may also interact with the VGD **12a** prompting the user to login or provide other identifying information. After or as part of logging in, the computing device **122** may query the VGD **12a** for information on its capabilities.

Computing device **122** may process request **214a** to look up the entitlements **202** associated with an account of the user stored in memory **142**. The lookup may include confirmation that the requesting VGD **12a** is authorized to receive a dynamic channel map **216a**, such as confirmation that the requesting VGD **12a** is correspondent to a paid subscriber, for example. Upon lookup, computing device **122** may match the requesting VGD **12a** with the user indicated as correspondent to that VGD **12a** in memory **142**, and may retrieve a list of services specified in the user's account to which the requesting user is entitled to access.

Based on the capabilities information received from VGD **12** and the services to which the user is entitled to access, computing device **122** may construct a dynamic channel map **216a** tailored to the services the requesting VGD **12a**

can render. For example, a VGD **12a** that can only render SD video channels would not receive information on HD video channels. VGD **12b**, also shown in FIG. 2, may similarly interact with the computing device **122** to obtain a dynamic channel map **216b**.

FIG. 3 illustrates two example dynamic channel maps **216a-b** in accordance with various aspects of the disclosure. Computing device **122** may generate dynamic channel maps **216a-b** by filtering the tier channel map **300** based on user entitlements and device capabilities. A dynamic channel map **216a** or **216b** may list services the requesting VGD is capable of rendering for the tier to which the user has subscribed. In an example, computing device **122** may create a first dynamic channel map **216a** for a VGD **12a** that cannot render HD content, and a second dynamic channel map **216b** for a VGD **12b** that can render HD content. Services that are available may also include applications, documents, games, etc. If a service is only available in one format but not the other (e.g., in HD but not SD), the dynamic channel map **216a** may indicate as such in the resolution column. For example, the HDNET channel may only be available in HD, and not SD, and the resolution column of the first dynamic channel map **216a** may indicate that the HDNET channel is unavailable. If a service is only available in SD, and a VGD **12** can render both HD and SD, computing device **122** may include that service in the second dynamic channel map **216b** and indicate its resolution. In an example, computing device **112** may generate and communicate dynamic channel maps **216a-b** to different VGDs **12** based on a tier entitlement associated with the same user's account.

In addition to user entitlements and device capabilities, computing device **122** may also consider other dynamic factors when generating a dynamic channel map **216**. Such other dynamic factors may include market-available sources, sources switched based on bandwidth use monitoring, sources dictated by targeting information, such as may be obtained from a user profile, or the like. By way of non-limiting example, monitoring of entitlements and device capabilities may provide metrics that allow for source selection based on bandwidth availability. More particularly, in accordance with an indication of usage by certain numbers of a particular device type, as reflected by requests **214**, sources may be switched to, or become selectable from, switched digital video (SDV) channels, for example. Thereby, determining a total number of requests **214** received from different VGDs **12** may provide metrics for unicast/SDV assignment calculations, for example.

In another example, network bandwidth conditions may be a dynamic factor in generating a dynamic channel map **216**. For example, computing device **122** may receive content from multiple Local Offices **120** or other content sources. If the VGD **12** is configured to stream content, computing device **122** may monitor bandwidth conditions of the network **124** between the computing device **122** and each of the Local Offices. For instance, computing device **122** may determine an amount of available bandwidth between itself and each of any applicable network nodes, which may be Local Offices or other nodes, and may store available network bandwidth parameters. Computing device **122** may exclude any Local Offices where there is insufficient available bandwidth to stream content from that Local Office. For example, content may require 5 Megabits per second (Mbps) and only 4 Mbps of bandwidth may be available to stream the content from a particular Local Office. For the remaining Local Offices, computing device **122** may select the Local Office having a highest amount of

available bandwidth and include a network address for that Local Office in the dynamic channel map **216**. The VGD **12** may then use the network address to access the content from the Local Office identified in the dynamic channel map **216**.

In a further example, geographic location of a VGD **12** may be a dynamic factor in generating a dynamic channel map **216**. For example, computing device **122** may determine a geographic location of the VGD **12** either by querying the VGD **12** or by other manners. As there may be certain geographic and timing restrictions on when content may be accessed, computing device **122** may generate the dynamic channel map **216** so that the VGD **16** may only access local sources for services.

FIG. **4** is a flow diagram illustrating a method **400** of generating a dynamic content interface, in accordance with various aspects of the disclosure. The method may be implemented by computing device **122**, or other apparatus or computing device. The steps identified in each block in the flow diagram may be omitted or repeated one or more times. The method may also repeat one or more times, as desired, in whole or in part. Also, the method may include blocks and steps other than the ones depicted.

At block **402**, a computing device may process a first request for a first dynamic content interface received from a first VGD and a second request for a second dynamic content interface received from a second VGD, wherein the first and second VGDs are associated with a user account. In an example, computing device **122** may receive a dynamic channel map request **216a** from VGD **12a** and a dynamic channel map request **216b** from VGD **12b**. Both VGDs **12a-b** may be associated with the same user, and hence with the same account of the user stored by memory **142**.

At block **404**, a computing device may generate the first dynamic content interface based on first capability information included in the first dynamic content interface request and a tier entitlement associated with the user account. In an example, computing device **122** may generate channel map **216a** based on capability information received in request **216a** and a tier entitlement associated with the user account.

At block **406**, a computing device may generate the second dynamic content interface based on second capability information included in the second dynamic content interface request and the tier entitlement associated with the account, wherein a service identified in both the first and second dynamic content interfaces is assigned a same virtual channel in each of the content interfaces. In an example, computing device **122** may generate channel map **216b** based on capability information received in request **216b**. Computing device **122** may assign a same virtual channel to a service included in both channel maps **216a-b**. The flow diagram may then end or return to any of the preceding blocks.

The example embodiments for dynamic content interface generation thus allow providers, such as MSOs, to deliver different content interfaces to different devices based on capabilities of a requesting video generation device and entitlements of a user. Thereby, the example embodiments for dynamic content interface generation simplify the maintenance of content interfaces for different provisioning systems, additionally allowing simplified support for alternative VGDs with distinct features, and additionally readily provides for the addition of, or modification of, available channels, such as newly available HD channels. For example, as new devices become capable of displaying video in newly available formats, such as low resolution MPEG4 format being provided for mobile devices, dynamic content interface generation delivers the appropriate content

interface, identifying appropriate video sources, based on capabilities of the device and user entitlements.

Those of ordinary skill in the art will recognize that many modifications and variations of the disclosure may be implemented without departing from its spirit or scope. Thus, it is intended that the disclosure cover the modifications and variations that come within the scope of the appended claims and their equivalents.

What is claimed is:

1. A method comprising:

determining, by a first computing device remotely located from a premise at which a second computing device is located, an amount of available bandwidth associated with the first computing device and each of a plurality of sources of a service;

determining that a first amount of available bandwidth associated with the first computing device and a first source, of the plurality of sources, does not satisfy an amount of bandwidth sufficient to stream the service;

generating, by removal of a first network address associated with the first source from a tier channel map and based on capability information of the second computing device and a tier entitlement associated with the second computing device, a first channel map;

transmitting the first channel map to the second computing device;

in response to determining that the first amount of available bandwidth associated with the first computing device and the first source satisfies the amount of bandwidth sufficient to stream the service, generating, based on the tier channel map, a second channel map comprising the first network address associated with the first source; and

transmitting the second channel map to the second computing device.

2. The method of claim **1**, wherein the first network address enables access to a data stream associated with the first source.

3. The method of claim **1**, wherein the first channel map comprises a second network address associated with a second source for the service of the plurality of sources for the service, wherein the second source has a highest amount of available bandwidth relative to other sources of the plurality of sources for the service.

4. The method of claim **1**, further comprising: determining a geographic location of the second computing device,

wherein the first channel map does not include a second network address associated with a second source for the service of the plurality of sources for the service, wherein the second source is not a local office for the second computing device.

5. The method of claim **1**, further comprising: receiving, by the first computing device and from the second computing device, a first request comprising the capability information of the second computing device.

6. The method of claim **5**, further comprising: receiving, by the first computing device and from a third computing device, a second request comprising capability information of the third computing device;

removing, from the tier channel map and based on the capability information of the third computing device and the tier entitlement associated with a user account, one or more network addresses to generate a third channel map; and

sending, by the first computing device and to the third computing device, the third channel map.

7. The method of claim 6, wherein the first channel map comprises a virtual channel and the third channel map comprises the virtual channel, the method further comprising:

assigning a standard definition version of the service to the virtual channel of the first channel map and a high definition version of the service to the virtual channel of the third channel map.

8. A method comprising:

generating, by a first computing device remotely located from a premise at which a second computing device is located, and based on a tier channel map, capability information of the second computing device, and a tier entitlement associated with the second computing device, a first channel map comprising a first network address associated with a first source, of a plurality of sources for a service, the first source having a highest amount of available bandwidth for streaming the service relative to other sources of the plurality of sources for the service;

transmitting the first channel map to the second computing device;

in response to determining that a first amount of available bandwidth associated with the first computing device and the first source does not satisfy an amount of bandwidth sufficient to stream the service, generating, based on removing the first network address associated with the first source from the tier channel map, a second channel map comprising a second network address associated with a second source of the plurality of sources for the service; and

transmitting the second channel map to the second computing device.

9. The method of claim 8, further comprising:

determining the amount of bandwidth sufficient for streaming the service;

determining that an amount of available bandwidth associated with the first computing device and the second source, of the plurality of sources for the service, is less than the amount of bandwidth sufficient for streaming the service; and

wherein the first channel map does not include the second network address associated with the second source.

10. The method of claim 8, wherein the first network address enables access to a data stream associated with the first source.

11. The method of claim 8, further comprising:

receiving, by the first computing device and from the second computing device, a first request comprising the capability information of the second computing device.

12. The method of claim 11, further comprising:

receiving, by the first computing device and from a third computing device, a second request comprising capability information of the third computing device;

removing, from the tier channel map and based on the capability information of the third computing device and the tier entitlement associated with a user account, one or more network addresses to generate a third channel map, the user account being associated with the third computing device; and

sending, by the first computing device and to the third computing device, the third channel map.

13. The method of claim 8, wherein the first channel map comprises a video channel lineup corresponding to a plurality of content creators.

14. The method of claim 8, further comprising:

determining a geographic location of the second computing device,

wherein the first channel map does not include a third source of the plurality of sources for the service, wherein the third source is not a local office for the second computing device.

15. A method comprising:

in response to determining, by a first computing device remotely located from a premise at which a second computing device is located, that a first source, of a plurality of sources of a service, has insufficient bandwidth associated with the first computing device and the first source to stream the service, generating, by removal of a first network address associated with the first source from a tier channel map and based on capability information of the second computing device and a tier entitlement associated with the second computing device, a first channel map comprising a second network address associated with a second source, of the plurality of sources for the service, that has sufficient available bandwidth associated with the first computing device and the second source to stream the service;

transmitting the first channel map to the second computing device;

in response to determining that the first source has sufficient bandwidth associated with the first computing device and the first source to stream the service, generating, based on the tier channel map, a second channel map comprising the first network address associated with the first source; and

transmitting the second channel map to the second computing device.

16. The method of claim 15, wherein the second source has a highest amount of available bandwidth relative to other sources of the plurality of sources for the service.

17. The method of claim 15, wherein the first network address associated with the first source enables access to a data stream associated with the first source.

18. The method of claim 15, wherein the first channel map comprises a plurality of virtual channel numbers, a plurality of a channel numbers, a plurality of frequencies, and a plurality of resolutions indicators.

19. The method of claim 15, further comprising:

receiving, by the first computing device and from the second computing device, a request comprising the capability information of the second computing device.

20. The method of claim 15, further comprising:

determining a geographic location of the second computing device,

wherein the first channel map does not include a network address associated with a third source for the service of the plurality of sources for the service, wherein the third source is not a local office for the second computing device.

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

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INVENTOR(S) : Patel et al.

Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

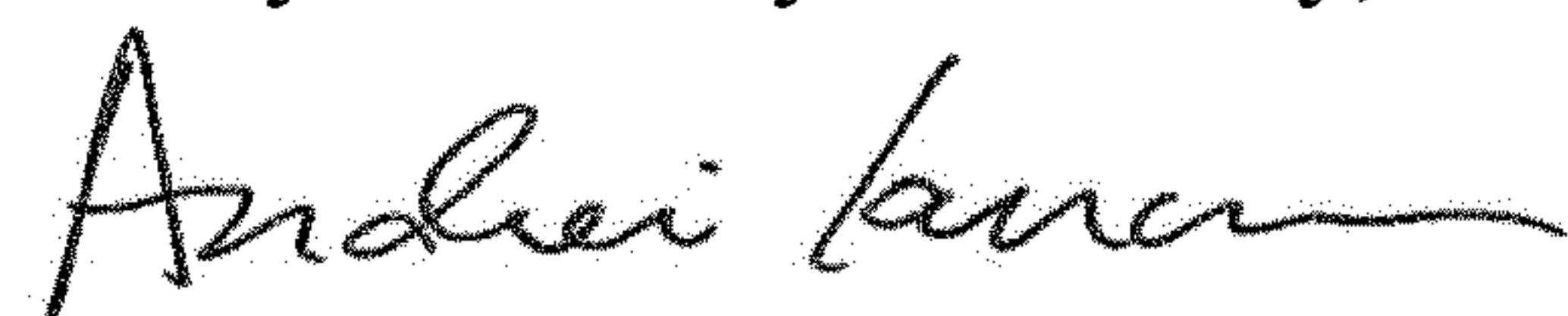
In the Specification

Column 5, Detailed Description, Line 39:
Please delete "VDG" and insert --VGD--

Column 6, Detailed Description, Line 28:
Delete "112" and insert --122--

Column 7, Detailed Description, Line 12:
Delete "16" and insert --12--

Signed and Sealed this
Twenty-ninth Day of January, 2019



Andrei Iancu
Director of the United States Patent and Trademark Office